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Fire Management Notes

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Fire Management Notes

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Contents

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Cover: The National Interagency Incident Management System (NIIMS) Glossary begins on p. 17.

Chain Saw Exhaust System Qualification [1]

Michael E. Smith and Boone Y. Richardson

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Some chain saw designs have been linked to accidental fires in forest and brushy areas. Fires such as those resulting from gas spills are immediately obvious and can quickly be put out. Others, such as exhaust-caused fires, may smolder undetected for some time and then burst into open flame. Often, these fires are not discovered in time to prevent their developing into major conflagrations.

The States of Oregon, Washington, and California require all chain saws and similar hand-held devices to be equipped with "qualified" exhaust systems. A qualified exhaust system is any device used on a combustion piston engine that retains or destroys a significant percentage of exhaust particles and has exhaust and exposed surface temperatures below the ignition point of fuels such as grass and bark. To quantify these qualifications, the Society of Automotive Engineers' (SAE) Standard J 335b was adopted in 1977.

Briefly, J 335b provides a uniform method of testing to evaluate the fire-ignition potential of an exhaust system on small multipurpose engines, and incorporates chain saw design requirements that will greatly reduce the fire danger of chain saw exhaust systems. The standard specifies that an exposed temperature may not exceed 550° F where the exhaust may contact a plane surface established by the extremities of the power unit. This means that with the chain bar removed, and the bucking bar installed, the temperature of any surface of the exhaust system that touches the ground may not exceed 550° F. Additionally, no exhaust gas temperature may exceed 475° F along these plane surfaces.

To qualify, all exhaust systems must have either a screen in the exhaust exit with openings no larger than 0.023 inch, or be designed so that 90 percent of all carbon particles are retained or destroyed. Presently, all qualification testing is performed at the U.S. Department of Agriculture, Forest Service, Equipment Development Center in San Dimas, Calif. The San Dimas Center has the only recognized spark arrester test facility for qualification in the United States.

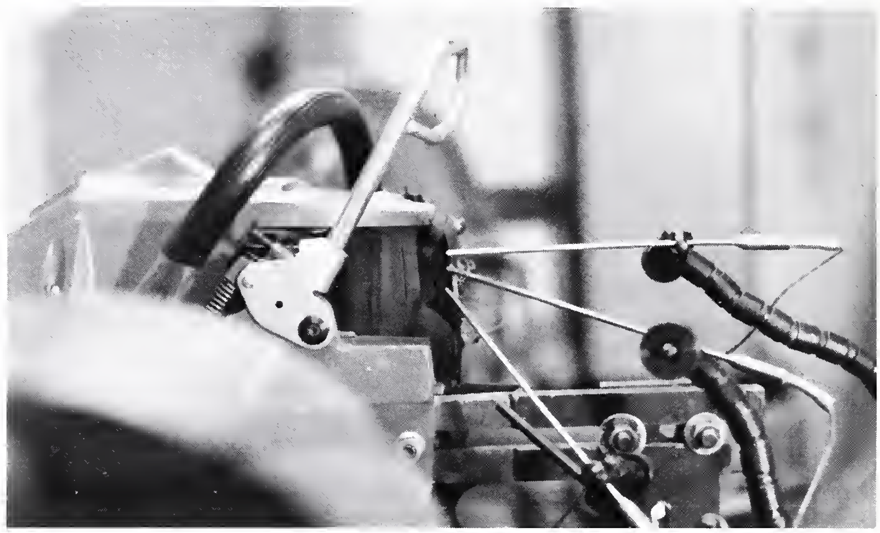
The center has achieved national recognition for its leadership in developing procedures, test equipment, and national standards for testing spark arrester and exhaust systems for gasoline, propane, and diesel engines. The center tests a wide variety of engines, from hand-held devices of fractional horsepower (hp) to the mighty locomotive diesel of nearly 2,350 hp.

The center conducts qualification tests under a cooperative test program. The manufacturer submits a test fee to cover direct and indirect costs of conducting the tests, and the Forest Service provides the test facilities and personnel. When the collection agreement has been completed between the manufacturer and the U.S. Government, the manufacturer submits a chain saw exhaust system, installed on a suitable chain saw and equipped as it would be used in the field for testing. Testing involves connection of the saw to a dynamometer and running the engine at its rated revolutions per minute (r/min). There are two dynamometers available, one for engines with ratings of 5 hp and less, the other for larger displacement engines. The dynamometer provides a uniform load to the chain saw and simulates field conditions. With a chain saw connected to the dynamometer and running at its rated r/min, surface and exhaust gas temperatures are obtained from thermocouples attached to the system and temperature probes. Temperatures are also recorded for 1,000 r/min above and below the rated r/min. This simulates conditions of wood cutting with a lean and rich fuel-setting mixture.

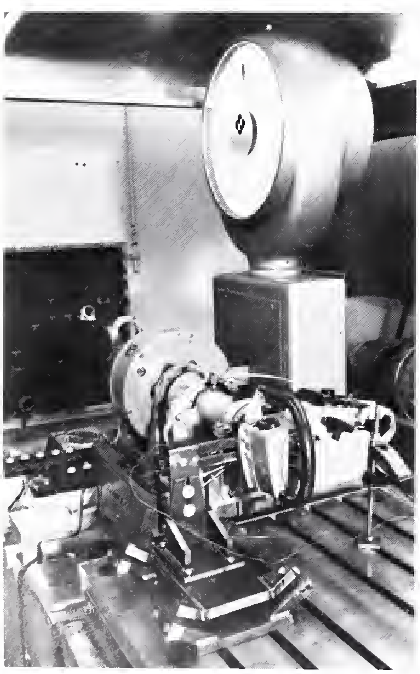
[1] Reprinted with permission from Chain Saw Age Magazine, Vol. 31 (6):32–33; 1982.

If the exhaust system is provided with a screen, it is checked by use of gages to insure there are no openings larger than 0.023 inch. However, if the system does not use a screen, it is tested in an arrester chamber having carbon and air blown through the system. To qualify, the system must retain or destroy at least 4.5 of 5 grams (90 percent) of carbon injected into the system's inlet in three positions—horizontal, vertical, and inverted.

If all tests are passed, a Notice of Qualification is issued for the system along with specific test results. The Notice of Qualification also designates what chain saws the system may be installed on. It must be understood, however, that the Forest Service is a qualifying agency only and does not endorse arrester systems.



Probes measure exhaust temperature from chain saw.



Dynamometer with chain saw attached.

Qualified exhaust systems are listed in a Spark Arrester Guide that is published by the U.S. Department of Agriculture, Forest Service. The qualified systems are listed in section II, Multiposition Small Spark Arresting Exhaust Systems, of the guide. The guide also includes qualified spark arresters for other engine types, including locomotives. Section II of the guide lists over 145 qualified exhaust systems, which may be properly installed on over 400 different chain saw models. ■

Underburning To Reduce Fire Hazard and Control Ips Beetles in Green Thinning Slash

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Slash from precommercial thinning in ponderosa pine creates a fire hazard and potential reservoir for insect infestation. Historically, thinning slash has been treated by mechanical means or by handpiling and burning. Mechanical treatment often causes adverse impacts such as soil compaction and damage to the residual stand; handpiling, the alternate method, is very expensive.

In an attempt to find an economical and environmentally acceptable method of hazard reduction, the Snow Mountain Ranger District of the Ochoco National Forest began underburning green thinning slash.

Site Description

The first burn area consisted of a 14-acre ponderosa pine site at an elevation of 5,000 feet. Slope was less than 10 percent on a western exposure. The stand contained 960 trees per acre before thinning. In January 1981, the stand was thinned to a spacing of 18 feet × 18 feet. Trees over 7 inches in diameter at breast height (d.b.h.) were not thinned unless they were deemed undesirable. Seedlings were not thinned since they would be killed by the underburn. Slash was lopped to less than 2 feet to keep average flame length around 3 feet.

A post-thinning exam of permanent plots revealed 284 trees per acre ranging from seedlings to trees 40 inches in diameter. Average d.b.h. measurements were 8.4 inches.

Fuel loading ranged from 8 to 12 tons per acre with the majority of fuel in the 0.3-inch class. Ips entrance holes were very numerous in slash on the site. No formal survey was conducted, but brood levels appeared to be moderate.

Burn Objectives

The objectives of the burn were to:

- Remove up to 90 percent of fine fuels (primarily needles).
- Remove no more than 40 percent of duff cover.
- Maintain 100 to 225 trees per acre.
- Limit scorch to 50 percent of green crown on leave trees.
- Destroy most of the second hatch of Ips pine engraver beetles in the slash prior to midsummer emergence.[1]

[1] Mitchell and Martin report that prescribed fire can be an effective tool for controlling the tree-killing July through August flight of beetles. Mitchell, R. G.; Martin, R. E. Fire and insects in pine cultures of the Pacific Northwest. In: Proceedings of the Sixth Conference on Fire and Forest Meteorology; 1980 April 22–24. Seattle, WA. Washington, DC: Society of American Foresters; 1980; 182–190.

The Prescription

The following prescription was developed in hopes of producing a maximum flame length of 4.5 feet with a desired average of 3 feet.

	Max.	Min.
Fine fuel moisture (percent)	12	8
Relative humidity (percent)	45	30
Windspeed (mi/h)	10	4
Temperature (° F)	75	40
Green fuel moisture (percent)	50	40

Since the critical item of the prescription was green fuel moisture, the rate of needle cure was monitored closely. Had green needles cured completely, it would have been difficult to obtain the desired 3-foot flame length. Ignition was planned for the cure phase when needles were still green and contained enough moisture to have a dampening effect on the fire, yet dry enough to be consumed.

Firing

Firing was begun at 5:30 p.m. on June 4 and completed in 3 hours. Strip head fires with a firing width of 10 to 15 feet were used. This strip width produced the desired flame length of 3 feet. Conditions at ignition time were:

Relative humidity	38 percent
Windspeed	5–8 mi/h
Fuel moisture (green)	50 percent
Temperature	70° F

Results

Approximately 75 percent of fine fuels were removed. A decrease in windspeed midway through the burn probably reduced fine fuel consumption.

Less than 40 percent of the duff cover was removed, and average crown scorch on trees left standing was 12 percent.

An examination of the postburn stand revealed that 196 trees per acre remained. These trees ranged from 1 to 40 inches in d.b.h. with an average size of 10-inch d.b.h. Two-thirds of all trees less than 4 inches in d.b.h. were removed; larger, more desirable trees were retained.

The burn produced temperatures high enough to significantly reduce Ips emergence from slash in July and August. No Ips infestation of living trees had occurred as of December 1981. Low numbers of Ips emergence holes were noted in mortality trees with high scorch levels. Ips may have contributed to the demise of these trees.

Approximately 3 percent of residual trees were infected by turpentine beetles. No mortality has occurred in these trees. No attacks by western pine beetles or mountain pine beetles have been observed.

Costs for the burn were approximately $40 per acre. Since it was necessary to conduct the burn after normal working hours to meet the prescription, much of this cost was due to overtime salaries.

Summary

The overall objectives of the burn were met. Timber and fire management personnel on the ranger district are enthusiastic about the operation and have planned several additional burns. It is felt that leave trees should be a minimum of 3 to 4 inches in d.b.h. and 20 feet tall before this treatment should be attempted. ■

INIAT: A Computer Program To Analyze Initial Action and First Reinforcement Times of Fire Suppression Forces

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Information on reported initial action and first reinforcement times and on the kind of forces dispatched is available from individual fire reports (Form 5100-29). Although data from past years may not reflect current fire policy, they may provide insight into dispatch decisions used in multiple fire situations and potential problems. Past data can also provide a basis for estimating initial action and first reinforcement times for multiple fires, as well as for estimating the probability of multiple fires occurring. The time-consuming process of assembling data from the individual fire reports can now be accomplished quickly by the computer program INIAT (INITIAL ATTACK).

This paper describes the information the INIAT program can provide. If developed for geographic areas appropriate for individual representative fire locations, some of the outputs could be of value in estimating travel times for initial action and reinforcement forces in the level II analysis process, as required by the Fire Management Analysis and Planning Handbook (Forest Service Handbook 5109.19).

INIAT Computer Program

The INIAT computer program is written in FORTRAN IV for operation on an IBM 370 computer. Copies are available from the Director, Pacific Southwest Forest and Range Experiment Station, P.O. Box 245, Berkeley, CA 94701, Attention: Statistical Services Group.[1]

The user selects the years of interest, national forests, and ranger districts of interest. The program provides the following:

- Reported time from fire detection to initial action and from initial action to first reinforcement by cover type, cause of fire (lightning or person), and multiple fire index.
- Kinds of initial action and first reinforcement forces—and probability of multiple fires by multiple fire index.
- Differences in reported initial action and first reinforcement times among multiple fires with various index numbers by cover type and cause of fire (lightning or person).

A fire is defined as a multiple fire of index i (i = 1, 2, . . ., 100) if the initial action time for that fire is between the initial action and control time of another fire within the geographic area of analysis. If two or more multiple fires occur, the multiple fire with the earliest initial action time is assigned an index of 1; the multiple fire with the second earliest initial action time, an index

[1] This program has not been through the systems review process, and is not approved for national use by Forest Service units.

Table 1.—*Distribution of lightning- and person-caused fires by multiple fire index for the Lolo National Forest, 1970–79*

Lightning-caused fires			Person-caused fires		
Multiple fire index	Frequency	Probability	Multiple fire index	Frequency	Probability
0	469	0.383	0	387	0.696
1	282	0.231	1	94	0.169
2	152	0.124	2	35	0.063
3	81	0.066	3	12	0.022
4	58	0.047	4	9	0.016
5	45	0.037	5	4	0.007
6	35	0.029	6	4	0.007
7	29	0.024	7	5	0.009
8	17	0.014	8	2	0.004
9	17	0.014	9	3	0.005
10	10	0.008	10	1	0.002
11	9	0.007			
12	11	0.009			
13	5	0.004			
14	3	0.002			

Table 2.—*Distribution of resources dispatched for both initial action and first reinforcement on lightning-caused fires with multiple fire indexes of 0, 1, and 2, Lolo National Forest, 1970–79*

Equipment	Initial action					First reinforcement				
	Dispatches		Percentiles			Dispatches		Percentiles		
			30th	50th	80th			30th	50th	80th
	Number	*Percent*[1]	- - *Minutes* - -			*Number*	*Percent*[1]	- - *Minutes* - -		
Multiple fire index = 0										
Dozer	0	0	0	0	0	0	0	0	0	0
Plows or trencher	0	0	0	0	0	0	0	0	0	0
Ground tanker or pumper	73	16.5	30	55	79	26	22.8	23	30	58
Ground force with tools	275	62.1	61	90	165	61	53.5	38	75	193
Helitanker	1	0.2	0	0	0	0	0	0	0	0
Air tanker	4	0.9	0	0	0	3	2.6	0	0	0
Smokejumper	30	6.8	76	89	123	8	7	0	0	0
Helicrew with tools	60	13.5	40	50	80	15	13.2	23	33	42
Multiple fire index = 1										
Dozer	2	0.7	0	0	0	0	0	0	0	0
Plows or trencher	0	0	0	0	0	0	0	0	0	0
Ground tanker or pumper	41	15.3	28	44	68	16	20.5	3	30	60
Ground force with tools	142	53	60	75	143	43	55.1	30	60	120
Helitanker	0	0	0	0	0	0	0	0	0	0
Air tanker	5	1.9	0	0	0	6	7.7	0	0	0
Smokejumper	28	10.4	72	95	138	3	3.8	0	0	0
Helicrew with tools	50	18.7	30	37	74	10	12.8	0	0	0
Multiple fire index = 2										
Dozer	0	0	0	0	0	0	0	0	0	0
Plows or trencher	1	0.7	0	0	0	0	0	0	0	0
Ground tanker or pumper	11	7.6	40	58	150	6	20	0	0	0
Ground force with tools	84	57.9	45	90	158	17	56.7	15	31	60
Helitanker	0	0	0	0	0	0	0	0	0	0
Air tanker	4	2.8	0	0	0	1	3.3	0	0	0
Smokejumper	21	14.5	67	103	150	5	16.7	0	0	0
Helicrew with tools	24	16.6	32	50	107	1	3.3	0	0	0

[1] Percents may not add to 100 due to rounding.

of 2, and so on. Single fires that do not overlap during the time from initial action to control of another fire are assigned an index of 0.

Sample Output

The following output for the Lolo National Forest from 1970 through 1979 typifies the information provided by INIAT.

- The distribution of both lightning- and person-caused multiple fires (table 1).
- The distribution of types of resources dispatched during both initial action and first reinforcement as a function of indexes 0, 1, and 2 for multiple lightning-caused fires (table 2). Use of air resources was greater on multiple fires, and not all fires received first reinforcements. Listed are the 30th, 50th, and 80th percentiles for initial action times in minutes. For example,

ground forces with tools took initial action 142 times on multiple fires with an index of 1; 30 percent of these actions came within 60 minutes of time of discovery, 50 percent within 75 minutes, and 80 percent within 143 minutes. The 142 fires represent 53 percent of all multiple fires with an index of 1. First reinforcement times, measured from the corresponding initial action times, are also listed at the same percentiles. The percentiles are not computed for resources for which the total number of dispatches was less than 10. The program lists the same information for up to nine multiple fires.

- The distribution of resources dispatched to person-caused fires (table 3). Road accessibility resulted in an emphasis on ground-transportable resources.
- The cumulative distribution of initial action time for multiple fires with indexes of 0, 1, 2, and 3 (fig. 1). The distributions for lightning-caused fires do not add to one because about 10 to 15 percent of all initial action times were in excess of 6 hours. Initial action time for multiple fires was slightly less than that for single fires. Accessibility of person-caused fires affected the distribution of initial action

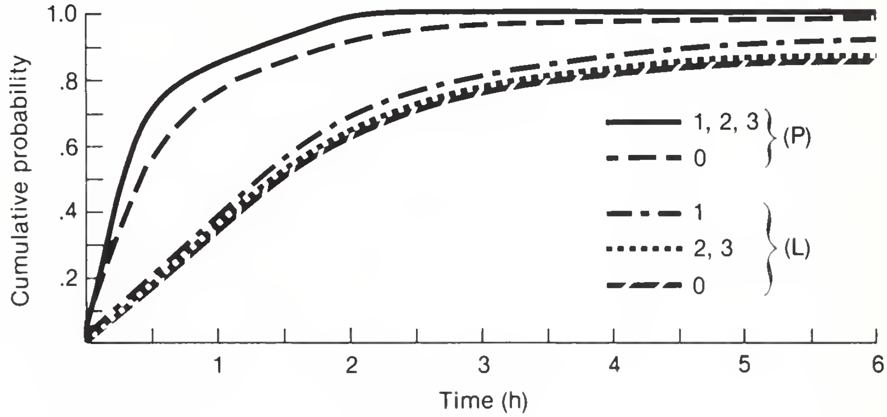


Figure 1.—*Cumulative probability distributions of initial action time for lightning- (L) and person-caused (P) multiple fires with indexes of 1, 2, and 3, and for single fires (multiple fire index of 0). The distributions for multiple fires do not add to one because 10 to 15 percent of all initial action times were longer than 6 hours.*

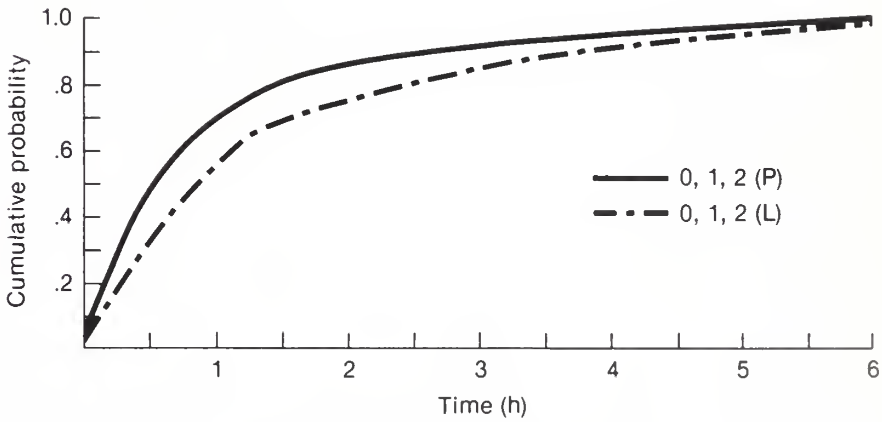


Figure 2.—*Cumulative probability distributions of first reinforcement time for lightning- (L) and person-caused (P) fires with multiple fire indexes of 0, 1, and 2.*

times because, on the average, lightning fires are remote.

- The cumulative distribution of elapsed time for first reinforcements for multiple fires with indexes of 0 through 2 (fig. 2). Initial action times (fig. 1) were slower than first reinforcement times for lightning-caused fires, especially within the first hour. The opposite was true for person-caused fires.
- For each multiple fire, the program subtracts the elapsed time from discovery to initial action from that for the corresponding initial fire. The remainder represents the time differential for initial action for a multiple fire compared with that of the corresponding initial fire (multiple fire index equal to 0).

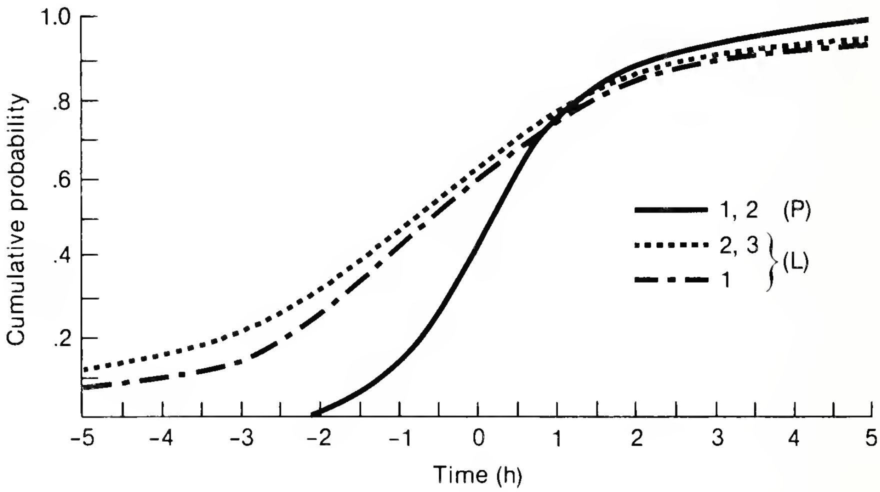


Figure 3.—*Cumulative probability distributions of initial action time differentials for lightning- (L) and person-caused (P) multiple fires with indexes of 1, 2, and 3.*

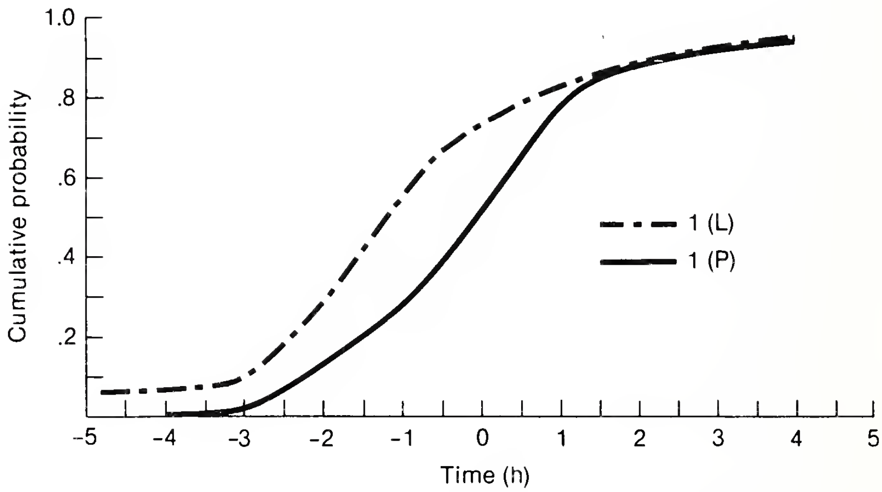


Figure 4.—*Cumulative probability distributions of first reinforcement time differentials for lightning- (L) and person-caused (P) multiple fires with an index of 1.*

Table 3.—*Distribution of resources dispatched for both initial action and first reinforcement on person-caused fires with multiple fire indexes of 0, 1, and 2, Lolo National Forest, 1970–79*

Equipment	Initial action					First reinforcement				
	Dispatches		Percentiles			Dispatches		Percentiles		
			30th	50th	80th			30th	50th	80th
	Number	*Percent*[1]	*- - Minutes - -*			*Number*	*Percent*[1]	*- - Minutes - -*		
Multiple fire index = 0										
Dozer	6	1.5	0	0	0	1	0.5	0	0	0
Plows or trencher	0	0	0	0	0	1	0.5	0	0	0
Ground tanker or pumper	186	45.1	15	25	60	86	46	19	28	59
Ground force with tools	204	49.5	6	20	50	91	48.7	15	30	75
Helitanker	0	0	0	0	0	0	0	0	0	0
Air tanker	2	0.5	0	0	0	2	1.1	0	0	0
Smokejumper	5	1.2	0	0	0	1	0.5	0	0	0
Helicrew with tools	9	2.2	0	0	0	5	2.7	0	0	0
Multiple fire index = 1										
Dozer	0	0	0	0	0	2	3.8	0	0	0
Plows or trencher	0	0	0	0	0	0	0	0	0	0
Ground tanker or pumper	49	45.4	15	22	30	23	44.2	10	15	30
Ground force with tools	54	50	5	10	28	22	42.3	10	15	58
Helitanker	1	0.9	0	0	0	0	0	0	0	0
Air tanker	1	0.9	0	0	0	4	7.7	0	0	0
Smokejumper	2	1.9	0	0	0	1	1.9	0	0	0
Helicrew with tools	1	0.9	0	0	0	0	0	0	0	0
Multiple fire index = 2										
Dozer	2	4.9	0	0	0	0	0	0	0	0
Plows or trencher	0	0	0	0	0	0	0	0	0	0
Ground tanker or pumper	16	39	6	10	19	9	45	0	0	0
Ground force with tools	22	53.7	4	5	25	10	50	0	0	0
Helitanker	0	0	0	0	0	0	0	0	0	0
Air tanker	0	0	0	0	0	1	5	0	0	0
Smokejumper	0	0	0	0	0	0	0	0	0	0
Helicrew with tools	1	2.4	0	0	0	0	0	0	0	0

[1] Percents may not add to 100 due to rounding.

The cumulative distribution of time differentials for initial action by multiple fire index are shown in figure 3. Negative time differentials are the result of a longer time between discovery and initial action on multiple fires than on the initial fire. Positive time differentials are the result of a shorter time for multiple fires than for the original fire. The curves for multiple fires with indexes 4 through 9 would be located near and to the left of the cumulative distribution curve for the multiple

fires with indexes 2 and 3. Their position indicates that time differentials for initial action increase with index number for multiple fires. Accessibility and the smaller number of multiple person-caused fires may again be the reason for the 60-percent positive time differentials for those fires.

- For each multiple fire, the program subtracts the elapsed time from initial action to first reinforcement from the corresponding elapsed time from initial action to first reinforcement for the initial fire. Again, the remainder represents the time differential for first reinforcement for a multiple fire compared with that for the corresponding initial fire.

The cumulative distributions (fig. 4) indicate a longer time between initial action and first reinforcements on multiple lightning-caused fires with an index of 1. The lack of data on first reinforcement times for multiple fires with indexes 2 through 9 precludes further evaluation.

On the basis of the INIAT program output, multiple fire occurrence had little effect on initial action times on the Lolo National Forest. Dispatch decisions differed for person-caused and lightning-caused fires (tables 2 and 3), but the kind of forces dispatched did not seem to vary with multiple fire index by cause. Comparison of the Lolo initial action time distributions with those of other national forests in the same area showed that distributions for the Lolo National Forest are also applicable outside the forest. ■

Only Everyone Can Prevent Forest Fires [1]

Richard Ernest

Chief, Region 2, California Department of Forestry, Santa Rosa, Calif.

This Nation has not chosen to undertake an aggressive fire prevention program in the rural and suburban parts of the United States. The fire agency leadership and those to whom it answers has not dedicated itself to the prevention of fire. This commitment must first be made before the cost and loss caused by fires can be reduced.

In those few areas where fire agencies have exerted a conscientious fire prevention effort, commendable reductions in fire incidence have occurred. In other areas where individuals have focused on a single cause of fire, reductions have occurred. In those same areas where these efforts have later been diverted, fire incidence has escalated. We in California can attest to that.

We believe that we know how fires can be prevented. We know what we need to do to keep fires from starting. We know that we need commitment to implement this knowledge—commitment from every level of leadership—all the way through top management to the legislative, judicial, and executive bodies of government. This commitment should be to budget for and manage a program that allows fire prevention specialists to prevent fires.

How do we do this? How do we prevent fires? We do it the same way we get people to stop smoking, to take annual physicals, or to wear their seatbelts. First, we educate those who are willing to be responsible and change their attitudes about the careless use of fire. Second, we scare the hell out of the rest of them with the warning that fire will cause bodily injury and loss of life, or announce that we will take away their money if they cause fire through negligence or violation of law.

You may not like these ideas, but one thing I can tell you, we cannot afford to allow citizens to learn to prevent fire by trial and error.

Past analysis by the California Department of Forestry (CDF) indicates that people who cause fires and experience the loss of life, injury, severe property damage, or criminal prosecution and civil litigation rarely cause another fire. In other words, nearly all fires in California, except for arson, are caused by first offenders.

How can we reach those people who for the first time get caught by fate and cause a fire? How about a good slogan? "Only you can prevent forest fires" boils down to the single most concise fire prevention statement that I can imagine. However, the common natural reaction to this statement is that "you" is certainly not "me." Additionally, the unasked question remains—why should "you" prevent fires? The aim of fire prevention should be to convince the public that this "you" is everyone, and that everyone who is identified as causing a fire will suffer some personal loss. The personal loss will be a significant loss in freedom or money, or a combination of the two.

No new laws are needed to accomplish this—at least in California. What fire agencies need to do a good job of prevention is adequate staffing and commitment. Without that commitment prevention is a joke.

The techniques of fire prevention are familiar to most of us. Some of you who are acquainted with CDF know that we have had our successes in prevention. Working in cooperation with personnel of the U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station and personnel from the Forest Service Washington Office, we have gained insight about our fire prevention problems and learned possible techniques for solving those problems. This work was part of the Wildfire Prevention Research Project, U.S. Department of Agriculture, Forest Service. We assisted in the development of the first spark arresters for large, high-volume

[1] Presented at the Fire Training Officers Conference, Jan. 18–20, 1983, Sacramento, Calif.

exhaust diesel engines. (Effective spark arresters for locomotive engines did not exist before this effort.) We developed an education program, whereby child-caused fires were reduced in California. The five-point program includes teaching packets for primary grade teachers and team teaching. Nothing like the five-point program existed in the world before we published the first part of the program in 1968.

Our efforts in the legislative field have been responsible for the existence of rural fire prevention statutes, second to none in the Nation. Outstanding among them are laws that require clearance around structures and electric power poles and conductors.

I must reiterate, we have sufficient laws. What we need to do now is to educate. Educate the public, educate the prosecutors and the courts, educate managers, supervisors, peers, and subordinates about how and why we should be committed to a fire prevention effort.

To do this job of education we need to have personal contact with the public. Currently, we do not have a sufficient number of trained employees to fill this need. Everyone of us should be working on this problem. Necessity, as you know, is the mother of invention.

Based on our fire service experiment of using volunteers for fire control, the CDF has activated a recruitment program to encourage citizen volunteers to help us in our fire prevention personal contact effort.

Originally, we recruited volunteers to help us perform hazard-reduction inspections around structures and to assist us in the presentation of our team-teaching programs on fire prevention to primary school children. Through our ranger unit Volunteers-In-Prevention pilot programs, people have volunteered for these two activities and others besides. For example, we have recruited a large number of ham radio enthusiasts who have helped us to establish a communication link on large fires. In 1983 this group plans to provide a communication link with our volunteer Air Force.

The volunteer Air Force is private airplane owners under CDF supervision that conduct high fire-hazard patrols. This program is similar to the Red Flag Ground Patrol that the CDF developed several years ago. Last year in one ranger unit alone, volunteers flew 290 flight hours at a cost of about $10 per hour. The CDF pays for aviation fuel only. This Air Force has been used effectively for fire detection and arson surveillance. We also have a ground-based volunteer arson task force that occasionally works with our Air Force.

One of the things that we have often stressed to this group and to our volunteer inspectors is that "citizen volunteers are not police officers and should not exhibit any actions that would lead the general public to believe otherwise."

The administration of a volunteer program costs time and money. Fortunately, the California legislature financed pilot programs in several ranger units, and this effort has proven to be economically beneficial to the people of the State of California. You and I know that getting this commitment for money to do this is not all that easy, but we must continue to carry this message to legislative bodies and others if we are ever to accomplish our goals.

The Pacific Southwest Forest and Range Experiment Station of the Forest Service, USDA, is studying volunteer efforts in our Tuolumne-Calaveras Ranger Unit, which we have activated at several geographically isolated sites. If our gut reaction is correct, this study should prove that CDF's Volunteers-In-Prevention program should be expanded throughout the State because it has allowed the CDF to complete currently unfunded fire prevention activities and reduce fire starts. We hope the Volunteers-In-Prevention program will cause other citizens to realize their fire prevention responsibilities, and make the public more fire conscious.

I hope this has given you an indication of some of the things that CDF is doing in the field of fire prevention and what we hope to do in the future. I would like to conclude with this thought: the U.S. Department of Agriculture, Forest Service, must provide leadership in the fire prevention, research, and development area. The original research program adopted by the National Wildfire Prevention Working Team was an outstanding start. Since that time, however, I get the feeling that the Forest Service has placed a low priority on prevention and research development. Without intending to be critical of our national working partner, I feel they need to reevaluate their position. Prevention will not work on lip service alone. Fire prevention will not work with money alone. Fire prevention will only work if we—all of us—commit ourselves to constantly convincing all people at every level of society that fire prevention is beneficial. And with the commitment of adequate staffing of qualified and dedicated people who are adequately financed, a balanced economic fire prevention program can be obtained. We should be satisfied with nothing less. ■

Rebuilding the Northern California Service Center—Consolidation After Tragedy

Janet Buzzini and Sid Nobles

Forest Information Specialist and Northern Zone Fire Dispatcher, USDA Forest Service, Shasta-Trinity National Forest, Redding, Calif.

On May 11, 1981, a building at the Northern California Service Center (NCSC) on Shasta-Trinity National Forest was destroyed by a plane crash. A U.S. Department of Agriculture (USDA), Forest Service, plane crashed on takeoff from the Redding, Calif., airport, killing four Forest Service employees and damaging the aircraft, the service center building, and the equipment it housed. The total cost of damage was estimated at between $7 and $8 million.

The USDA, Forest Service (FS) operated the NCSC in support of cooperative wildland fire protection operations in northern California. The building that was demolished served as a warehouse, parachute loft, training facility, and office.

Despite the accident, the NCSC has continued to respond to emergency firefighting needs and calls for assistance in northern California. Personnel at NCSC have taken up every available covered space since the accident. Barracks were turned into offices and the dispatch office, smokejumper crew, hotshot crew, and the fire cache have occupied makeshift quarters in the conference facility and part of the aircraft hangar.

Plans for Interagency Consolidation

Immediately following the accident, a special interagency task force studied the damage to the building and considered the possibility of a joint California Department of Forestry (CDF) and USDAFS facility to increase the efficiency of both agencies. The lease on the Redding-based CDF facility is due to expire in June 1985, anyway. And the task force decided that the NCSC site could accommodate both agencies. The Redding Emergency Service Center's United Effort (RESCUE) proposal envisions six separate missions for the 40-acre NCSC site.

The Administrations Complex. The new administration building will house joint host and information services for USDAFS and the CDF, the CDF region II headquarters office, north zone coordinator's office, training facilities, conference rooms, regional suppression crew office, and computer systems and electronic support.

The Aviation Unit. The North Zone Aviation Unit will function from its existing office and hangar space. The unit includes the hangar, zone office, call-when-needed pilot ready room, and avionics shop.

A CDF Fire Station. The CDF plans to build a new fire station on the compound. It will provide housing for 2 engines, parking for 1 dozer transport, barracks for 20 people, a mess hall for 50 people, and fuel islands.

The Research and Non-Fire Units. The USDAFS Pacific Southwest Forest and Range Experiment Station and the Region 5 sign shop will be changed.

A Living Memorial. [1] A memorial has been begun for the four employees who lost their lives at the NCSC. Long-range plans call for a bronze plaque remembering Roscoe Bertolucci, Joe Hohl, George Mendel, and Larry Pettibone who lost their lives in the plane crash. Four redwood trees, provided by the Chico Tree Improvement Center, have been planted on the site. Completion and dedication of the living memorial are planned to coincide with the opening of the operations facility later this year.

Input for the site plan was gathered from all the units and agencies involved in protecting northern California's wildlands: the CDF, city of

[1] People wishing to make donations to the living memorial may contact The Northern California Employees' Association, c/o Ricki Miller, 6101 Airport Road, Redding, CA 96002.

Redding, the county of Shasta, the USDA (Forest Service) Pacific Southwest Forest and Range Experiment Station, North Zone Air Unit, NCSC, and other Forest Service units. The final plan takes into account the need for expansion and development in the future.

The New Operations Building

Construction of the new operations building to replace the NCSC building is expected to begin sometime in mid-March 1983. The FS and the CDF hope to occupy the operations building before the end of November 1983. The 29,000-square-foot, 2-story structure will house an interagency dispatch, an interagency fire cache, a multi-agency coordination facility, fire weather forecasters, a smokejumper unit, and support facilities for a regional suppression crew. ■

The National Interagency Incident Management System—A Glossary of Terms

The adoption of the National Interagency Incident Management System (NIIMS) by a growing number of wildland suppression agencies requires the development and use of common terminology. Communication between agencies is greatly enhanced when they use the same terms for organizational functions, resources, and facilities. This is particularly true for a management system that will be used on multi-agency incidents.

A glossary of terms was originally developed for the Incident Command System in southern California. As NIIMS was adopted by the partner agencies of the National Wildfire Coordinating Group (NWCG), it was felt that the glossary should be modified to reflect national needs. The NWCG training team was charged with gathering and incorporating terms into a glossary for presentation to NWCG at its January 1983 meeting. NWCG adopted the recommended glossary and has, in turn, recommended it to all wildland fire protection agencies. It is anticipated that as the agencies adopt NIIMS, the glossary will become an integral part of the system.

The glossary of terms represents a national core of terms. Additional terms may be added in the future as approved by NWCG. Each State, Federal agency, or local area may have terms that will be added as supplements to the glossary.

To date, the U.S. Department of Agriculture (Forest Service) and the National Park Service and the Bureau of Land Management, both of the U.S. Department of the Interior (USDI), have adopted NIIMS. The USDI Bureau of Indian Affairs is in the process of adopting the system, and the USDI Fish and Wildlife Service will adopt NIIMS on a case-by-case basis when partner agencies adjacent to wildlife refuges adopt NIIMS.

States now actively implementing NIIMS include California, Florida, Nevada, and Colorado. A number of other States have decided to adopt NIIMS and are in the planning process, or will adopt in concert with their partner Federal agencies.

Agency Representative: An individual assigned to an incident from an assisting or cooperating agency who has been delegated full authority to make decisions on all matters affecting the agency's participation at the incident. Agency representatives report to the incident liaison officer.

Aerial Torch: An ignition device, suspended under a helicopter, capable of dispensing ignited fuel to the ground for assistance in burnout or backfiring.

Air Tanker: Any fixed-wing aircraft certified by the Federal Aviation Administration as being capable of transport and delivery of fire retardant solutions.

Allocated Resources: Resources dispatched to an incident that have not yet checked in with the incident communications center.

Assigned Resources: Resources that have been checked in and assigned work tasks on an incident.

Assisting Agency: An agency directly contributing suppression, rescue, support, or service resources to another agency.

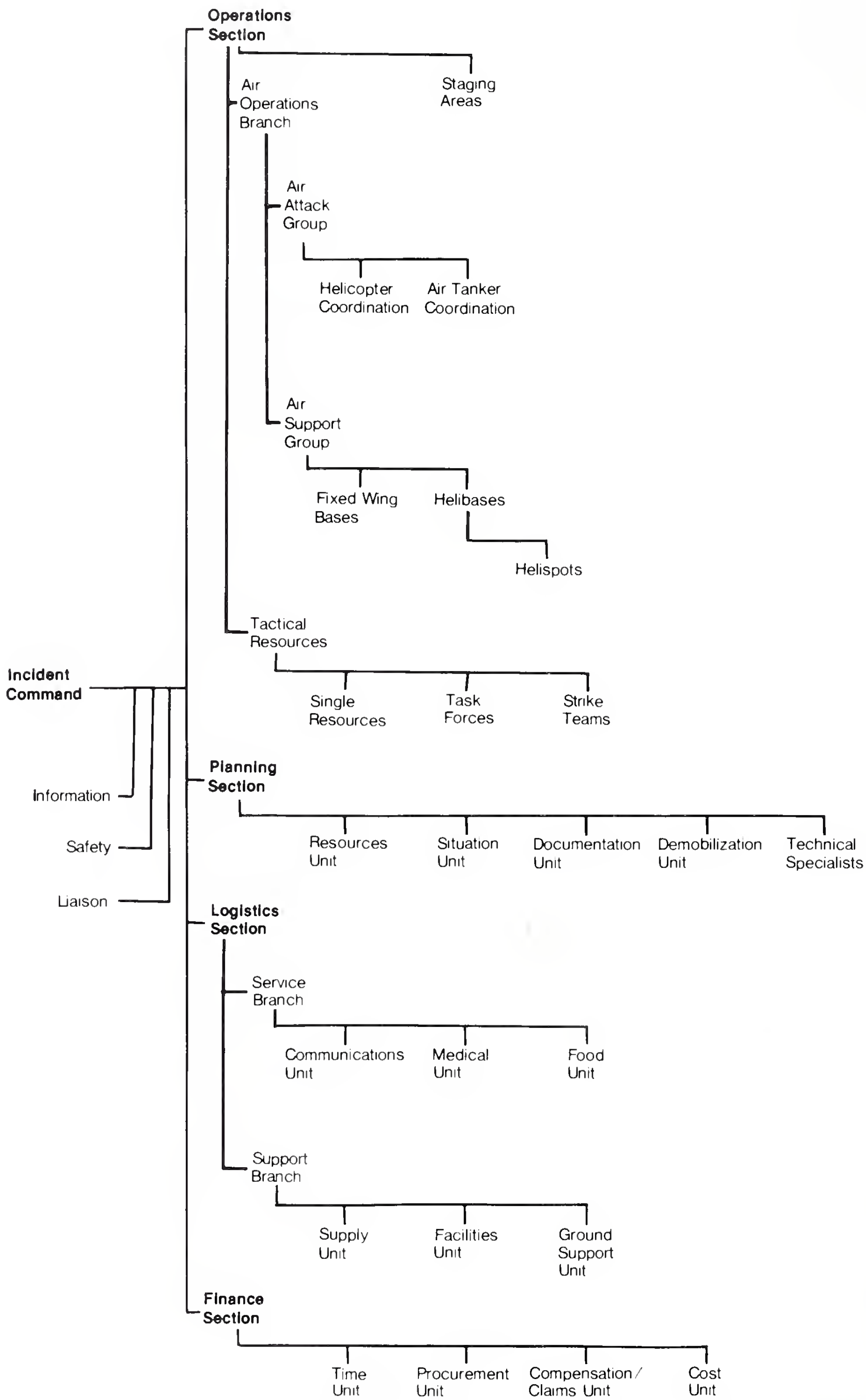
Available Resources: Resources assigned to an incident and available for an assignment within 3 minutes.

Branch: The organizational level having functional or geographic responsibility for major segments of incident operations. The branch level is organizationally between section and division or group.

Camp: A geographical site within the general incident area, separate from the incident base and equipped and staffed to provide sleeping, food, water, and sanitary services to incident personnel.

Check In: Locations where assigned resources check in at an incident. The locations are: Incident Command Post (Resources Unit), Incident Base,

Organization of NIIMS Incident Command



Camps, Staging Areas, Helibases, Division Supervisors (for direct line assignments). Check in at one location only and complete the ICS form 211.

Clear Text: The use of plain English in radio communications transmissions. No ten codes or agency-specific codes are used when using clear text.

Command: The act of directing, ordering, and/or controlling resources by virtue of explicit legal, agency, or delegated authority.

Command Staff: The command staff consists of the information officer, safety officer, and liaison officer, who report directly to the incident commander.

Communications Unit (Comm. Unit): A facility used to provide the major part of an incident communications center.

Company: Any piece of equipment having a full complement of personnel.

Coordination: The process of systematically analyzing a situation, developing relevant information, and informing appropriate *command* authority (for its decision) of viable alternatives for selection of the most effective combination of available resources to meet specific objectives. The coordination process (which can be either intra-agency or interagency) does not in and of itself involve command dispatch actions. Personnel responsible for coordination may perform command or dispatch functions within limits established by specific agency delegations, procedures, legal authority, and the like.

Cooperating Agency: An agency supplying assistance other than direct suppression, rescue, support, or service functions to the incident control effort (e.g., Red Cross, law enforcement agency, telephone company, etc.).

Dispatch: The implementation of a *command* decision to move a resource or resources from one place to another.

Dispatch Center: A facility from which resources are directly assigned to an incident.

Division: Divisions are normally established to divide an incident into *geographical* areas of operation. Divisions are established when the number of resources exceeds the span-of-control of the operations chief. A division is supervised within the organization between the task force/strike team and the branch. (Also see "Group.")

Dozer Company: Any dozer with a minimum complement of two persons.

Engine: Any ground vehicle providing specified levels of pumping, water, and hose capacity, but with less than the specified level of personnel.

Engine Company: Any ground vehicle providing specified levels of pumping, water, hose capacity, and personnel.

Food Dispenser: Any resource capable of dispensing food to incident personnel.

Fuel Tender: Any vehicle capable of supplying fuel to ground or airborne equipment.

General Staff: The group of incident management personnel comprised of incident commander, operations chief, planning chief, logistics chief, and finance chief.

Group: Groups are normally established to divide the incident into *functional* areas or operation. Groups are composed of resources assembled to perform a special function not necessarily within a single geographic division.

Hand Crew: A number of individuals that have been organized and trained, and are supervised principally for

operational assignments on a incident.

Heavy Equipment Transport: Any ground vehicle capable of transporting a dozer.

Helibase: The main location within the general incident area for parking, fueling, maintenance, and loading of helicopters. It is usually located at or near the incident base.

Helibase Crew: A crew of individuals who may be assigned to operations or to support helicopter operations.

Helicopter Tender: A ground service vehicle capable of supplying fuel and support equipment to helicopters.

Helispot: A location where a helicopter can take off and land. Some helispots may be used for temporary retardant loading.

Helitack: The initial attack phase of fire suppression involving helicopters and trained airborne teams to achieve immediate control of wildfires.

Helitack Foreman: A firefighter trained in the tactical and logistical use of helicopters for fire suppression.

Helitanker: A helicopter equipped with a fixed tank or a suspended bucket-type container that is used for aerial delivery of water or retardants.

Incident Action Plan: A set of objectives reflecting the overall incident strategy and specific control actions for the next operational period. When complete, the incident action plan will have a number of attachments.

Incident: An occurrence or event, caused by humans or by natural phenomena, that requires action by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

Incident Base: That location at which the primary logistics functions are coordinated and administered. (Incident name or other designator will be added to the term "base.") The incident command post may be colocated with the base. There is only one base per incident.

Incident Command System: The combination of facilities, equipment, personnel, procedures, and communications operating with a common organizational structure and with responsibility for the management of assigned resources to effectively accomplish stated objectives pertaining to an incident.

Incident Commander (IC): The individual responsible for the management of all incident operations.

Incident Command Post (ICP): The location where the primary command functions are executed. (The ICP is usually colocated with the incident base.)

Initial Attack: The control efforts taken by resources that are the first to arrive at an incident.

Infrared (IR): A heat detection system used for fire detection, mapping, and hot spot identification.

Infrared (IR) Groundlink: A capability through the use of a special mobile ground station to receive air-to-ground infrared imagery at an incident.

Jurisdictional Agency: The agency having jurisdiction and responsibility for a specific geographical area.

Liaison Officer: A member of the command staff responsible for interacting with agency representatives from assisting and cooperating agencies.

Management By Objective (MBO): Top-down management so that all involved know and understand the objectives of the operation.

Message Center: The message center is part of the incident communications center and is colocated or placed adjacent to it. It receives, records, and routes information about resources reporting to the incident, resource status, and administration and tactical traffic.

Mobilization Center: An *off-incident* location where emergency service personnel and equipment are temporarily located pending assignment, release, or reassignment.

Multi-Agency Coordination System (MACS): A generalized term that describes the combination of facilities, equipment, personnel, procedures, and communications integrated into a common system with responsibility for coordination of assisting agency resources and support to agency emergency operations.

National Interagency Incident Management System (NIIMS): A system of five major subsystems which collectively provide a total systems approach to all-risk incident management. The subsystems are: the incident command system, training, qualifications and certification, supporting technologies, and publications management.

NOAA Weather Station: A mobile weather data collection and forecasting facility (including personnel) provided by the National Oceanic and Atmospheric Administration which can be utilized within the incident area.

Operations Coordination Center (OCC): The primary facility of the multi-agency coordination system. It houses the staff and equipment necessary to perform the MACS functions.

Operational Period: The period of time scheduled for execution of a given set of operation actions as specified in the incident action plan.

Orthophoto Maps: Aerial photographs corrected to scale such that geographic measurements may be taken directly from the prints. They may contain graphically emphasized geographic features and may be provided with overlays of such features as water systems, important facility location, and similar features.

Out-of-Service Resources: Resources assigned to an incident but unable to respond for mechanical, rest, or personal reasons.

Overhead Personnel: Personnel who are assigned to supervisory positions, including incident commander, command staff, general staff, directors, supervisors, and unit leaders.

Patrol Unit: Any light mobile unit having limited pumping and water capacity.

Planning Meeting: A meeting, held as needed throughout the duration of an incident, to select specific strategies and tactics for incident control operations and for service and support planning.

Radio Cache: A number of portable radios, a base station, and in some cases a repeater stored in a predetermined location for dispatch to incidents.

Reinforced Attack: Those resources requested in addition to the initial attack resources.

Reporting to an Incident: Notifying appropriate incident personnel of arrival at an incident.

Rescue Medical: Any manned ground vehicle capable of providing emergency medical services.

Resources: All personnel and major items of equipment available, or potentially available, for assignment to incident tasks on which status is maintained.

RESTAT: An acronym for the resources status unit, a unit within the planning section responsible for tracking resources assigned to an incident.

Section: That organization level having functional responsibility for the primary segments of the incident, such as operations, planning, logistics, and finance. The section is organizationally between branch and incident commander.

SITSTAT: An acronym for the situation status unit, a unit within the planning section responsible for keeping track of incident events.

Span-of-Control: The supervisory ratio of from three to seven individuals. (Five is the general rule.)

Staging Area: A temporary on-incident location where incident personnel and equipment are assigned on a 3-minute-available status.

Strike Team: Specified combinations of the same kind and type of resources, with common communications and a leader.

Task Force: Any combination of resources with common communications and a leader.

Technical Specialists: Personnel with special skills who are activated only when needed. Technical specialists may be needed in the areas of fire behavior, water resources, environmental concerns, resource use, and training.

Tractor Plow: Any tracked vehicle with a plow for exposing mineral soil. (The term also implies the equipment necessary for the plow's transportation and personnel for its operation.)

Unified Command: A method by which agencies or individuals with jurisdictional or functional responsibility at incidents participate in determining the objectives for the incident, and selecting the strategy to achieve the objectives.

Unit: The organizational element having functional responsibility for a specific incident planning, logistics, or finance activity.

Water Tender: Any ground vehicle capable of transporting specified quantities of water. ■

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News and Notes

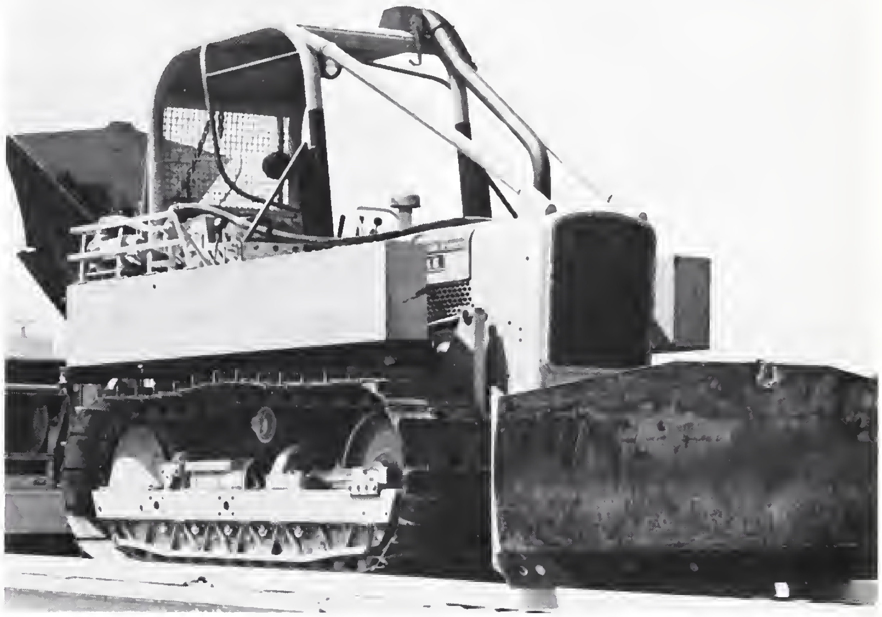
Protection for Tractor Drivers

The Wisconsin Department of Natural Resources is adopting a new system to protect tractor drivers while they are fighting forest fires.

The more than 80 vehicles in the State's tractor fleet are currently equipped with 150-gallon tanks of water and hoses for fire suppression, to aid in mopping up, and for the drivers' protection. But even these modifications were not sufficient to save one driver who lost his life in a fire in April 1982.

Equipment operator John Brevik, who was serving on the same fire in 1982, has developed another modification to protect tractor drivers. He proposed installing in each tractor a set of sprinkler heads that, when activated by a lever, could release a canopy of water over the cockpit and driver.

Variations were tested until the most effective design was found. According to Gordon Landphier, Wisconsin Department of National Resources Fire Supervisor, the system will be installed on all tractors. Using tanks already in place, the sprinkler system provides up to 8 minutes of protection, ample for normal fire emergencies. As the water is released, it keeps drivers cool, shields them from smoke and flame, and sets up air currents that give added protection.



A tractor fitted with water tank and sprinkler heads to protect operators from fire.

Besides enhancing the safety of the driver, the system improves suppression capability. It enables tractor drivers to move closer to the fire because of the availability of water on the tractor. The sprinkler heads, hose, and hardware necessary to modify the existing system cost approximately $50.

Additional information is available by contacting Gordon Landphier at P.O. Box 7921, Madison, WI 53707. ■

Weedburner—An Effective Prescribed Burning Tool

A diesel-fueled agricultural weedburner has proved an effective tool for prescribed burning of rangeland on the Crooked River National Grassland and Ochoco National Forest in Oregon.

The burner consists of a tripod-mounted boom and motor. The 5-horsepower motor drives both the fuel pump and blower. The blower forces air down the boom to the burner head. In the burner head, diesel fuel and air are mixed, fired by an electrical ignitor, and blasted out in a 4-foot-wide flame.

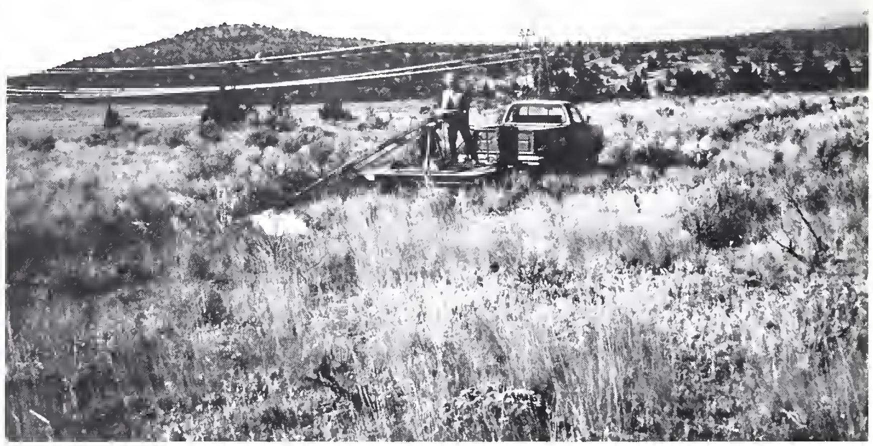
The burner can be mounted on a plywood base and slipped into a pickup bed, or used on a trailer behind a tractor. The boom swings through a 360-degree horizontal arc and 45-degree vertical arc. Two 30-gallon drums mounted with the burner usually provide sufficient fuel to last through a full burning day.

Operators can be trained on the device in a few minutes. In practice, one person operates the burner while a second person drives. Aside from the usual care exercised around diesel fuel, no unusual safety precautions are necessary with the weedburner.

With the weedburner, blackline can be installed while grass is still green. The hot flame consumes green grass in a 4-foot swath that later serves as an effective barrier when grass in the burn area cures.

When humidity is high, blackline can be rapidly constructed in cured grass and brush, since fuel outside the flame's influence will not carry fire. We have found that blacklines are often best constructed with the weedburner during early morning hours. The burner can also be used in conjunction with a pumper to build rapid wetline. Wetlines and blacklines are cost effective for rangeland burning, and avoid potential adverse impacts associated with constructed firelines.

During firing operations, fire can be set as rapidly as the truck or tractor can be safely driven.



The trailer-mounted weedburner being used to build blackline.

The boom is easily moved around trees and other obstacles, and raised or lowered to fire cut banks or ditches. Rapid firing of units with the burner contributes to smoke dispersal and reduces holding and firing costs.

With its large, hot flame and its potential for rapid movement along roads or firebreaks, the burner may be useful for backfire operations on wildfires.

The model described can be obtained from Hydraulics Unlimited Manufacturing Co., Eaton, CO. Total cost for the unit is under $700. Maintenance costs after 2 years of operation have been negligible. ■

John Maupin
Fire Staff Officer
Ochoco National Forest
Prineville, Oreg.
Van Elsbernd
District Ranger
Crooked River National Grassland
Prineville, Oreg.
Frank Russell
Fire Management Officer
Crooked River National Grassland
Prineville, Oreg.

Pictures Say It Better Than Words

The accumulation of dead, woody debris on the forest floor can spell big trouble as a fire hazard. The U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station has recently published three field manuals that can help managers in Montana and nearby Idaho forests deal with the problem.

The manuals contain color photographs showing different levels of downed woody material resulting from natural processes. Each photo is supplemented by inventory data describing the size, weight, volume, and condition of the pictured debris. The guides are designed to help forest managers describe the deadwood on the forest floor, to estimate the amount of such material, and to evaluate its fire hazard. The photos in each report show a variety of fuel situations that exist in several different forest cover types in Montana and the surrounding northern Rocky Mountain areas.

Bill Fischer, research forester in the Fire Effects and Use Research and Development Program at the Station's Northern Forest Fire Laboratory, Missoula, Mont., compiled the guides. He believes the strongest feature of the series is the fire-potential rating with each photo. Alternative methods for evaluating fire potential are generally unavailable, and those methods that do exist are outdated or not well suited for rating nonuniform fuel situations.

If you would like copies of these guides, write to the Intermountain Forest and Range Experiment Station for:

Fischer, William C. Photo guide for appraising downed woody fuels in Montana forests: Grand fir–larch–Douglas-fir; western hemlock; western hemlock–western redcedar; and western redcedar cover types. Gen. Tech. Rep. INT-96. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1981. 53 p.

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Fischer, William C. Photo guide for appraising downed woody fuels in Montana forests: Lodgepole pine and Engelmann spruce–subalpine fir cover types. Gen. Tech. Rep. INT-98. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1981. 143 p.

Land managers interested in developing photo guides for their areas will find helpful information in:

Fischer, William C. Photo guides for appraising downed woody fuels in Montana forests: How they were made. Res. Note INT-299. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1982. 12 p.

The note also contains the procedure used to rate potential fire behavior of the fuel shown in each photo. ■

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